UNILATERAL URETEROPELVIC JUNCTION OBSTRUCTION IN CHILDREN – FOLLOWUP AFTER PYELOPLASTY

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CERTIFICATE

This is to certify that the dissertation entitled **UNILATERAL URETEROPELVIC JUNCTION OBSTRUCTION IN CHILDREN – FOLLOWUP AFTER PYELOPLASTY** is a bonafide work done by **Dr.K. Saravanan** in our Institution during the period of post graduate study for M.Ch Paediatric surgery from the year September 2006 to August 2009

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Coimbatore Medical College & Hospital

Coimbatore

CERTIFICATE

This is to certify that the dissertation entitled **UNILATERAL URETEROPELVIC JUNCTION OBSTRUCTION IN CHILDREN – FOLLOWUP AFTER PYELOPLASTY** submitted in partial fulfillment of the requirements for the award of degree of M.Ch Paediatric Surgery is a bonafide work carried by **Dr. K. Saravanan** under my supervision and guidance in the department of Paediatric Surgery, Coimbatore Medical College, Coimbatore

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CONTENTS

Introduction

Ureteropelvic junction (UPJ) obstruction is defined as an obstruction of the flow of urine from the renal pelvis to the proximal ureter. The resultant back pressure within the renal pelvis may lead to progressive renal damage and deterioration.

UPJ obstruction presents most frequently in childhood, but adults and elderly individuals also can present with a primary obstructive lesion. In adults, other etiologies for ureteral obstruction must be considered, including stones, ureteral compression due to retroperitoneal fibrosis, and other inflammatory processes.

Dismembered Anderson-Hynes pyeloplasty is the Gold standard surgical treatment for ureteropelvic junction obstruction (UPJO). The goal of pediatric pyeloplasty is to reduce hydronephrosis and preserve renal function.

Successful pyeloplasty relieves symptoms and improves renal drainage, but the functional outcome after pyeloplasty continues to be debated because not all kidneys show improvement after surgery. In addition, there is considerable controversy in the literature on the final functional outcome and the factors influencing functional improvement after pyeloplasty [1-3].

Renal ultrasound defines a successful pyeloplasty as improvement in Society of Fetal Urology (SFU) grading of hydronephrosis, temporal axial growth of the ipsilateral kidney and gradual increase in renal parenchyma. According to diuretic renography,

successful pyeloplasty is demonstrated by improved urinary drainage and differential renal function (DRF).

As surgeons, our major concern is to postoperatively recognize whether the kidney remains truly obstructed after pyeloplasty. In order to detect true obstruction after pyeloplasty, we reviewed and analyzed data derived from pre-operative and post-operative results from standardized diuretic renography and ultrasonography.

OBJECTIVE

Follow up of postoperative renal function in those patients who underwent pyeloplasty for unilateral Congenital Ureteropelvic Junction Obstruction.

MATERIALS AND METHODS

The children who underwent dismembered pyeloplasty for unilateral Ureteropelvic junction obstruction from January 2005 to June 2008 were included in the study. Patients with bilateral disease, associated vesicoureteral reflux, or significant postoperative complications requiring reintervention were excluded from this study. The surgical indications were based on progressive increase in hydronephrosis, prolonged renal drainage, symptomatic ureteropelvic junction obstruction and deteriorating renal function. Standard Anderson-Hynes pyeloplasties with internal ureteral stent placement were performed. Those patients included in the study were evaluated preoperatively with renal ultrasonography and 99mTc- DTPA diuretic renography to confirm obstructed hydronephrosis. Ultrasonography was undertaken during the initial examination and repeated 3 months or later after surgery. The degree of hydronephrosis was graded according to the Society of Fetal Urology (SFU) grading system (Table 1) [7].

Table 1: Society of Fetal Urology grading of Hydronephrosis (SFU)

SFU grade	Description
1	Slight splitting of the central renal complex without calyceal involvement, normal parenchyma
2	Splitting of central renal complex with extension to non dilated calyces
3	Wide splitting of the renal pelvis, dilated outside the renal border, calyces uniformly dilated, normal parenchyma

4	Large, dilated calyces (may appear convex) thinning of the parenchyma to < 50% often ipsilateral kidney

Follow-up 99mTc DTPA diuretic renography were obtained at 6 months or later. An absolute increase in DRF of more than 5% in the operated kidney was considered significant [8, 9]. A change in DRF of within 5% of the preoperative level was defined as stable renal function. For diuretic renography, all patients were well hydrated before the diuretic study. Imaging was performed in the supine position with the scintillation camera below the table. Up to 20 mg (1 mg/kg) of furosemide was injected intravenously at 20 min after injection of 185-296 MBq (5-8 mCi) of 99mTc-DTPA. Patients were asked to stand up and empty their bladders before the furosemide injection. Clearance half-time of the radioactive urine from each side of the renal pelvis was calculated with background subtraction by exponential curve fitting after the furosemide injection.[11] Clearance half-time of less than 20 min on DTPA diuretic renography was interpreted as normal renal drainage. Prolonged renal drainage was defined as a half-time of greater than 20 min [12].

Ultrasonographic findings on grade of hydronephrosis, Glomerular filtration rate (GFR) and differential renal function (DRF) on diuretic renogram were compared between preoperative and post operative patients. The results are analysed and the percentage change in renal function is noted. Post operative complications and outcome of the patients were also analysed.

LITERATURE REVIEW

UPJ obstruction is twice common in males as females, particularly in the neonatal period, with 66% occurring on the left side [13, 14] as opposed to adults in which there is a predilection for the right side [15]. Bilateral cases of UPJ obstruction occur in 10 – 36% of patients, with the highest percentage found in the younger age group [(16, 17)]

UPJ obstruction is the most common cause of antenatal and neonatal hydronephrosis. Approximately 1 in 100 pregnancies are noted to have fetal upper tract dilation on ultrasound. However, only 1 in 500 will be found to have significant urologic problems.

Prior to the use of prenatal ultrasound, most patients with UPJ obstruction presented with pain, hematuria, urosepsis, failure to thrive, or a palpable mass. With the enhanced ability and availability of prenatal ultrasound, urologic abnormalities are being diagnosed earlier and more frequently. Fifty percent of patients diagnosed with antenatal hydronephrosis will be diagnosed with a UPJ obstruction upon further workup.

Etiology

Possible etiologies for UPJ obstruction include the following:

- Intrinsic obstruction secondary to stenosis from scarring of ureteral valves.
- Ureteral hypoplasia may result in abnormal peristalsis through the UPJ. Asymmetry of ureteral wall musculature may inhibit the natural peristaltic

emptying of the renal pelvis into the ureter.

- Abnormal or a high insertion of the ureter into the renal pelvis may cause an altered configuration and impaired drainage of urine. This may be an effect rather than a cause because the two etiologies mentioned previously may present with a high-insertion variant seen on imaging studies.
- Crossing lower pole renal vessel(s) or entrapment of the ureter by a vessel can prohibit urinary flow down the ureter. Vessels that wrap around the UPJ may be associated with obstruction or can be a product of renal dilation and hydronephrosis that distorts renal vascular architecture.
- Rotation of the kidney, such as renal ectopy, and renal hypermobility can cause intermittent obstruction that is solely dependent on the position of the kidney relative to the ureter. This was once a very popular diagnosis, but today, the other aforementioned etiologies are more prevalent and this cause is particularly rare.
- Secondary UPJ obstruction can be caused by prior surgical intervention for other disorders, such as renal stone disease or failed repair of a primary UPJ obstruction. This obstructive lesion most commonly is secondary to ureteral wall and periureteral scar formation [51].

The above abnormalities all cause impaired drainage of urine from the kidney into the ureter, resulting in elevated intrarenal back pressure, dilation of the collecting system, and hydronephrosis.

Evaluation

Neonates presenting with hydronephrosis should be fully evaluated with both voiding cystourethrogram (VCUG) to rule out vesicoureteral reflux and renal ultrasound soon after birth. These patients should also be placed on prophylactic antibiotics (amoxicillin 15 mg/kg) to prevent urinary tract infections (UTIs), especially while diagnostic imaging is being obtained. If renal sonography demonstrates hydronephrosis without reflux on VCUG, a diuretic renal scan mercaptotriglycylglycine [MAG-3], diethylenetriaminepentaacidic acid [DTPA], or dimercaptosuccinic acid [DMSA]) should be performed to quantify relative renal function and to define the extent of obstruction.

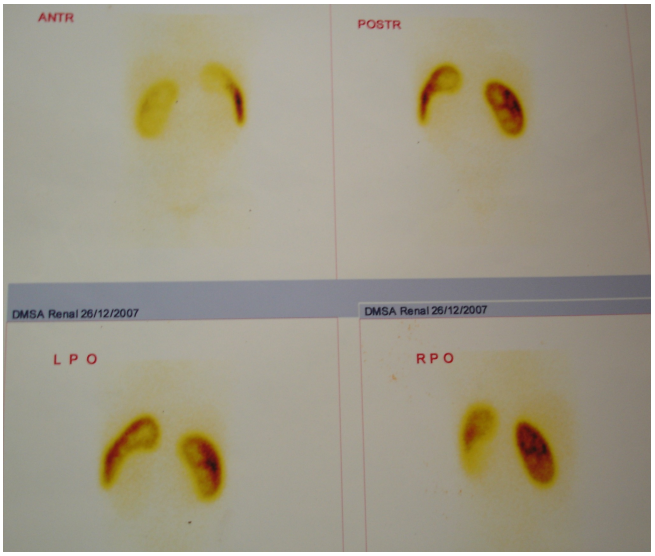
Older children may present with UTIs, a flank mass or intermittent flank pain secondary to a primary UPJ obstruction. Hematuria also may be a presenting sign if associated with infection.

The society of fetal urology (SFU) organized consensus guidelines for grading different degrees of hydronephrosis (Table 1) [17]

The majority of antenatally detected genitourinary abnormalities are unlikely to require postnatal surgical intervention [18, 19]. In fact only 1% - 25% requires surgical intervention [18, 19]. The survival rate for fetuses found to have unilateral hydronephrosis secondary to obstruction virtually is 100%. To realize this excellent prognosis for

unilateral hydronephrosis, postnatal followup is essential to temporally track the progression of hydronephrosis, as well as establish the management principle with the family.

Differential Diagnosis



Obstructive causes of hydronephrosis include UPJ obstruction (44%). Ureterovesical junction (UVJ) obstruction 21%, Multicystic kidney disease, ureterocele, and duplicated collecting system (12%); posterior urethral valves (9%) and ectopic ureter, urethral atresia, sacrococcygeal teratoma, and hydrometrocolopos. Non obstructive causes of hydronephrosis include Vesicoureteric Reflux (VUR) (14%), physiologic dilatation, prune belly syndrome, renal cystic diseases and megacalicosis [20, 21].

nvestigations

Intravenous urography

As an imaging study, it combines anatomic accuracy with qualitative information regarding renal function and obstruction. It may be useful in clarifying anatomic curiosities suggested by ultrasound, but in general, IVU is fairly obsolete in the assessment of a pediatric patient with obstructive uropathy. Obstruction of the kidney

can be recognized as a delay in the appearance of contrast material or a negative nephrogram, a delay in drainage, a rounded renal contour, dilution of contrast medium, or uniform cortical loss.

It is not a study of choice in neonates because renal function is immature at this stage and even the normal kidney is unable to acidify or concentrate urine for the first 4 – 6 weeks of life. Therefore the intravenous contrast used for the IVU provides poor visualization of neonatal kidney, IVU is difficult to interpret when the patient is poorly hydrated or has underlying renal insufficiency [22].

Renal ultrasound

Renal ultrasound is a widely available, relatively inexpensive, non invasive, safe test that provides adequate anatomic visualization without radiation exposure. Renal ultrasound is the most commonly performed initial study for the postnatal evaluation of neonates who have been discovered prenatally to have hydronephrosis and should be done ideally after 48 to 72 hours. Renal ultrasound is highly accurate in the diagnosis of hydronephrosis. It provides relatively good information on findings characteristic of UPJ obstruction, including pelviectasis, caliectasis, no evidence of ipsilateral ureterectasis, normal bladder filling and emptying (cycling), and normal bladder thickness. Ransley and colleagues established that progressive hydronephrosis and deterioration in renal function were uncommon in neonates and infants with a maximum anteroposterior renal pelvic diameter of less that 10mm and evidence of infundibular or caliceal dilation (SFU

grade 1 hydronephrosis) [23]. All the patients initially in the nonoperative group who eventually required surgery had a prenatal anteroposterior renal pelvic diameter of greater than 12 mm. how ever renal pelvic diameter was found to be poor positive predictor of outcome because only 34% of such patients required pyeloplasty.

Koff and coworkers proposed the use of serial renal ultrasound to predict progression in unilateral cases of UPJ obstruction [24]. In addition to being able to monitor the temporal behavior of UPJ obstruction, serial renal ultrasound provides the ability to track the axial growth of the kidneys as an indicator of progression of UPJ obstruction. Reflecting on Koff and colleagues study it is logical to conclude that in patients with unilateral hydronephrosis, contra lateral compensatory renal hypertrophy may indicate a greater risk of continued deterioration of the hydronephrotic kidney [24]. However, reliable sonographic diagnosis of renal hypertrophy requires multiple sequential measurement of renal length or volume, thus limiting its applicability for guiding early intervention [25] (fig 1)

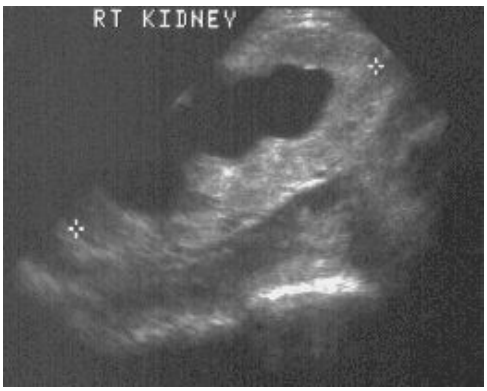


Fig 1: Hydronephrosis – USG

Technetium 99m Renal Scintigraphy

Differential renal function is one of the most important parameters used in detecting a functionally significant obstruction and, as such, predicting the optimum time for surgical correction of congenital UPJ obstruction. Renal scintigraphy is the study of choice for estimation of overall and differential renal function. Technitium 99m diethylenetriamine pentaacetic acid (Tc – DTPA) and Technitium 99m mercaptoacetyltriglycine (Tc MAG – 3) are preferentially concentrated by the kidney and freely filtered by the glomerulus (26). DTPA is neither secreted nor resorbed by the renal tubules, whereas MAG – 3 are preferentially concentrated by the kidney and freely filtered by the glomerulus [(26)]. (Fig 2 – 5)

The third agent, technetium 99m dimercaptosuccinic acid (Tc DMSA) , is tightly bound to renal tubular cells and is , therefore, useful for the detection of differential renal function and clinically significant cortical lesions such as renal scars. Atleast three consensus statement have been published to decrease the wide clinical variance in protocols; the society of Nuclear Medicine's Nuclear Medicine procedure Guidelines for pediatric diuretic Renography, the "well tempered Diuretic Renogram" and the consensus statement from the ninth International Meeting of the Society of Radionuclides in Nephrourology, very similar in methodology, as well as interpretation.

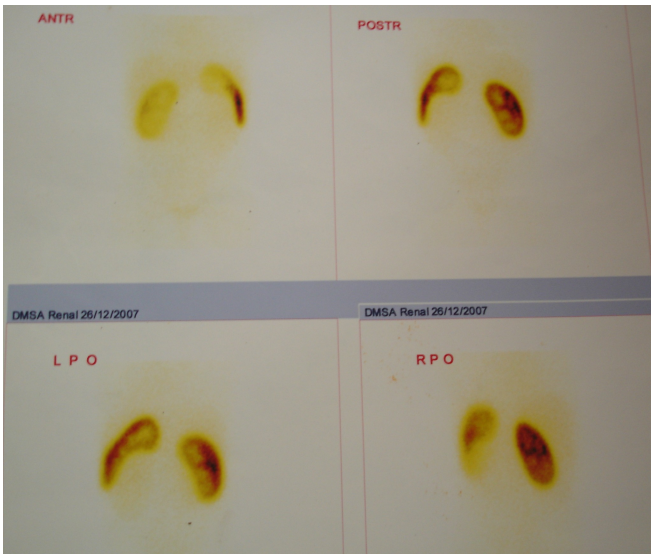


Fig 2: Diuretic Renogram – Right Hydronephrosis

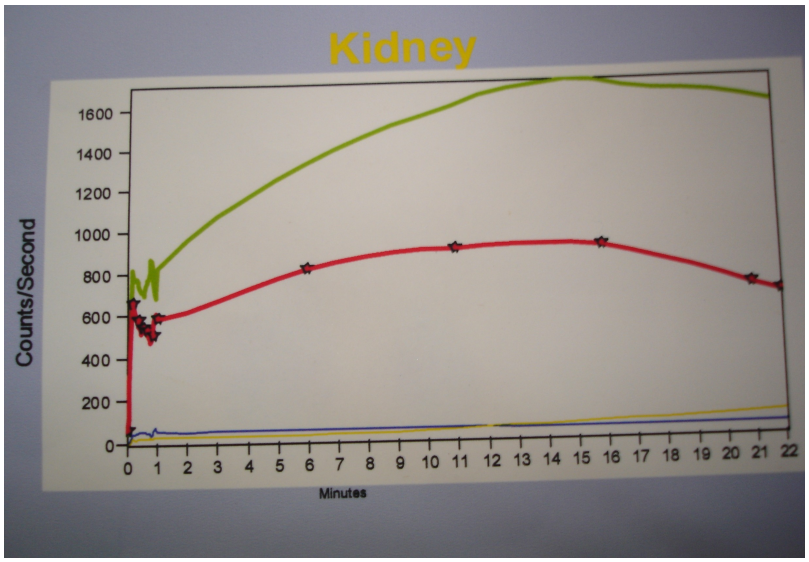


Fig: 3 diuretic renogram: obstructive curve pattern (green curve)

Basically, a collecting system without significant obstruction will have a clearance half time (i.e., the time for half the radiopharmaceutical to clear) after

furosemide administration of less than 10 minutes. Longer than 20 minutes is abnormal and associated with high grade obstruction. Clearance half times between 10 and 20 minutes are considered indeterminate. The half – time should not be the only criterion on which to define obstruction.

Currently, renal scintigraphy is the most popular modality for determining the functional significance of UPJ obstruction, mainly because several investigators have shown that most cases of severe hydronephrosis (SFU grade 3 to 4) demonstrate obstruction on diuretic renography [27]. As a result of these studies, the differential renal function of hydronephrotic kidney as determined by 99m Tc DTPA or Tc MAG3 renal scan creates an arbitrary threshold for surgical intervention [28]. If the initial differential renal function is greater than 35%, the neonate can be monitored conservatively by renal ultrasound every 3 months. In contrast, if the differential renal function is less than 35% on the initial study of there is a detrimental change in function of 10% by repeat scan, [29] and due consideration should be given to surgical intervention.

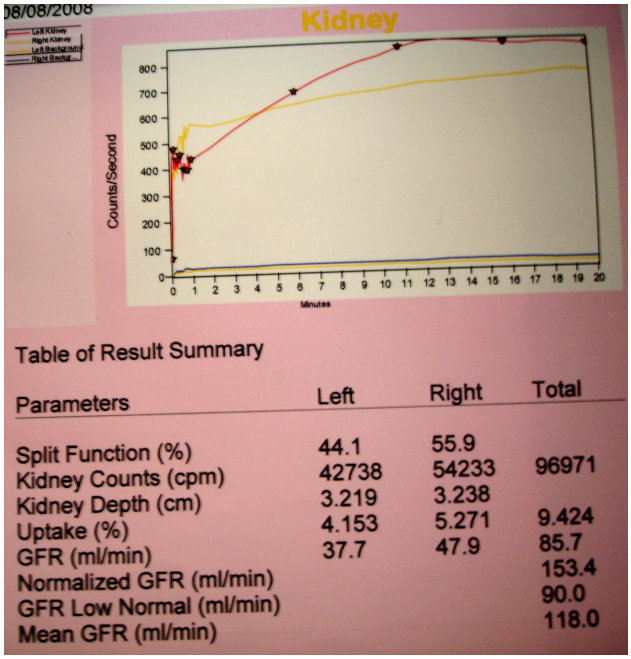


Fig 4: Diuretic renogram: graph pattern

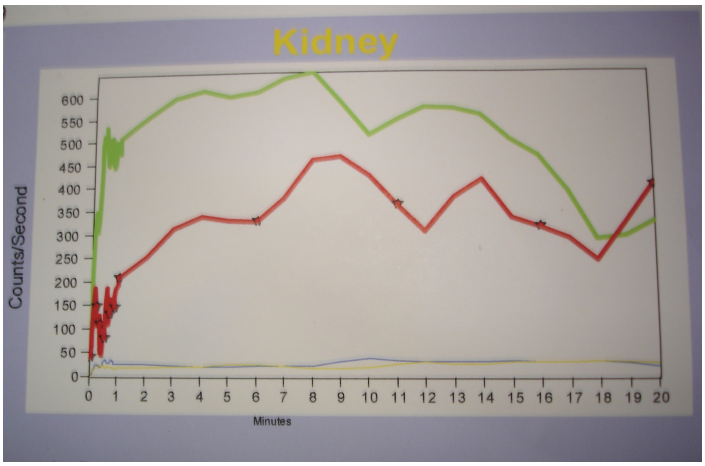


Fig 5: diuretic renogram

Renal scintigraphy is the study of choice for the estimation of overall and differential renal function, except in patients with poor or immature renal function and also those with capacious collecting systems. Other determinates that affect renal scintigraphy include the region of interest, time of measurement, state of hydration, bladder fullness, reservoir effect, type of protocol, renal response to lasix, and the concept of supranormal function [30, 31].

Supranormal function is defined as greater than 55% of differential renal function in the hydronephrotic kidney in children with unilateral hydronephrosis. It has not been confirmed whether supranormal differential renal function is an artifact of a true finding,

nor is there a consensus on how to manage these patients. Khan and associates believe that supranormal function is an artifact that can be avoided by using MAG – 3 and appropriate computer software to account for multiple algorithms [32]

Diuretic renography remains the noninvasive functional study of choice to assess the functional status of the kidneys and the pattern of clearance [37]. However, the recent knowledge on the maturation of the newborn kidneys has helped fixing the timing of the initial study after 4 weeks of life [37, 38] .The reliability of the test has greatly improved with the development of standardized protocols [37, 38] and with the use of the modified renogram. [39, 40, 41] .

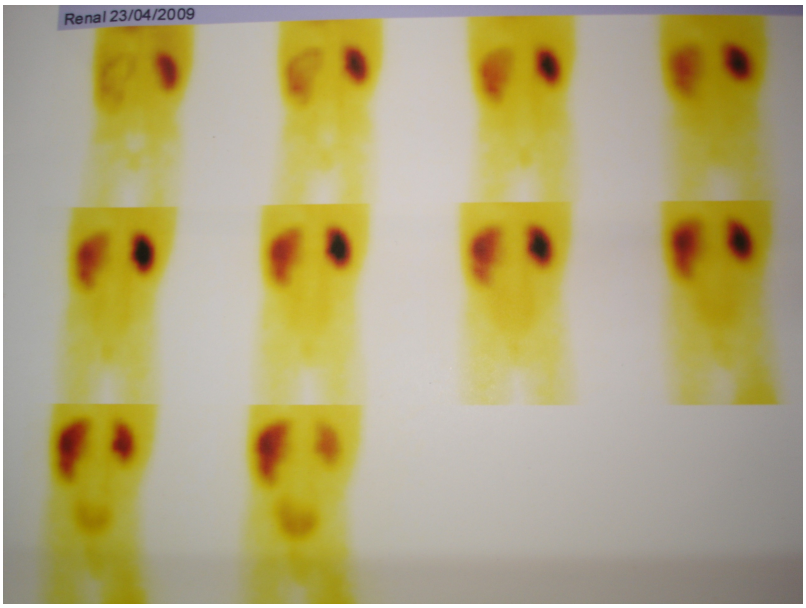


Fig 6: Diuretic renogram: post op hydronephrosis on left side

Micturating Cytourethrogram (MCU)

Approximately 9% to 14% of patients with UPJ obstruction have VUR [33].

Conversely, 1% of patients found to have VUR are found to have UPJ obstruction. Consequently, voiding cystourethrography is the standard of practice for the clinical evaluation of all infants with prenatal hydronephrosis, regardless of age or gender[34, 35].

Anatomic consideration

The evaluation of an obstructed UPJ requires information about ureteral and surrounding anatomy, renal position and ectopy, associated vasculature, and renal function. Prior to surgical intervention, the surgeon frequently evaluates for renal position/ectopy, mobility, and UPJ anatomy, such as high-insertion variants versus annular stricture variants.

The major vascular supply of the UPJ comes from branches of the renal artery. These vessels usually lie in an anteromedial location in relation to the proximal ureter. Aberrant polar vessels also may be associated with the renal pelvis, causing compression and obstruction of the collecting system. These vessels arise from either the renal artery from a position proximal to the main intrarenal branching site or directly from the aorta. They can surround the UPJ and can be associated with obstruction, or they may be aberrantly positioned secondary to increasing hydronephrosis.

The vascular anatomy at the UPJ becomes crucial when performing an endopyelotomy. The renal collecting system may be accessed percutaneously (antegrade) or in a retrograde fashion where a ureteroscope is passed through the

urethra, bladder, and ureter to access the obstruction and perform an incision.

Multidetector CT scan with 3-dimensional reconstruction can be particularly helpful in establishing the anatomy of UPJ obstruction, revealing an intrinsic or high-insertion UPJ. Crossing vessels and their relationship to the ureter of the UPJ can also be evaluated. The location of these vessels and their possible contribution to renal obstruction can help the surgeon clinically decide whether endopyelotomy, open pyeloplasty, or laparoscopic pyeloplasty would be the most effective treatment modality.

When an open or laparoscopic pyeloplasty is performed, an accurate understanding of the vascular anatomy allows the surgeon to preserve the accessory renal vessels and to redirect them if the surgeon feels that they contribute to the obstruction. If an endopyelotomy is planned, this information can guide the surgeon in directing the endopyelotomy incision away from crossing vessels.

Goal of treatment

The goals in treating patients with UPJ obstruction are to improve renal drainage and to maintain or improve renal function.

As mentioned previously, dilation of the intrarenal collecting system or hydronephrosis does not necessarily imply obstruction. Specifically in children, renal pelvic dilatation should be followed with serial imaging to assess for changes in

dilatation, renal parenchymal thickness, the presence of scarring, and function. Surgical repair is indicated if a significant obstruction in serial imaging is present or if progressive deterioration of renal function occurs.

Using this algorithm, patients with hydronephrosis are monitored closely with renal ultrasounds and nuclear medicine renograms every 3-6 months. Similarly, in adults, repair is recommended if ureteral obstruction is demonstrated on nuclear medicine renal scan or intravenous pyelogram (IVP).

Surgery

Dismembered Andersen-Hynes pyeloplasty is the surgical procedure most popular for the treatment of intrinsic pelviureteric junction obstruction in pediatric population [42 - 45]. The procedure eliminates the diseased segment and re-establishes the continuity of urinary tract (46). The goal of surgery for UPJ obstruction is to preserve renal function by facilitating unobstructed drainage of the renal pelvis. It involves complete removal of the narrowed (dysfunctional) segment, tailoring the renal pelvis (if necessary), and reapproximation of the ureter to the renal pelvis in a dependent position.

Pyeloplasty is performed under general anesthesia with the option of using a regional block. Child is placed in a supine position with a small sand bag elevating the flank of the operating side. Anterior sub costal, muscle splitting approach, which provides excellent exposure through a small incision. The peritoneum is reflected medially. Gerota's fascia is incised in a plane vertical to the patient. Retractor is used to expose

the kidney.

Once the kidney and renal pelvis have been exposed, careful inspection of the anatomy should allow a decision to be made regarding the best technique to use. When a decision is made to perform a dismembered pyeloplasty, the renal pelvis should be evaluated for possible reduction in size. Stay suture are strategically positioned in a "diamond" pattern, and tenotomy scissor are used to excise the renal pelvis within the borders of the stay sutures. One sweeping incision is made in a superior to inferior manner. This maneuver provides a smooth contour for an adequate anastomosis to the ureter. The proximal, narrowed ureteral segment should be incised distally enough to provide healthy ureteral tissue of normal caliber. Before reapproximation of the ureter to the pelvis, distal ureteral length should be tested to ensure that the anastomosis will be tension free. The anastomosis is begun at the inferior apex with continuous, interlocking 7 -0 absorbable monofilament suture. During the anastomosis, care should be taken to include adequate adventitial tissue with less mucosal tissue to provide a watertight anastomosis. A temporary ureteral stent may be used when performing the anastomosis to reduce the risk for obstruction as a result of "back walling". Alternatively a Double J ureteral stent may be positioned in the distal end of the ureter and may be positioned in the distal end of the ureter and bladder with the seldinger technique. This stent may remain in place for 4 to 6 weeks.

The other technique include Foley Y – V plasty when the obstructing segment is longer than 1.5 to 2cm, spiral flap in a child with a small extra renal pelvis and the renal

pelvis does not need to reduced.

Other approaches for pyeloplasty

Posterior lumbotomy

The patient is placed in a prone position with roll under the chest, pelvis and knees. After the skin incision, scarpas fascia is sharply incised and a vertical incision is made through the lumbodorsal fascia. The lateral edge of the lumbodorsal fascia is elevated, and the sacrospinalis muscle is medially retracted. The Quadrator lumborum muscle is retracted, exposing Gerota's fascia beneath the paranephric fat and then this fascia is opened. The renal pelvis is identified, holding stitch is placed in the ureter, and the surgery proceed with dismembered pyeloplasty.

Flank approach

The patient is placed over the kidney rest in a flank position, the kidney rest in elevated and the operating room table is flexed. The skin incision is made of the tip of supracostal 12^{th} rib incision is made. The external oblique and latissimus dorsi muscles are divided. Next the internal oblique and serratus posterior inferior muscle are divided. The transversalis muscle is often is often thin and can be divided with digital dissection. The peritoneum is identified and retracted medially. Gerota's fascia is then encircled and opened longitudinally to gain experience to the perinephric space. After identification of the renal pelvis dismembered pyeloplasty is done.

Alternative technique

Endoscopic approach

This approach has been successful in both antegrade and retrograde fashion. The initial attempts at balloon dilatation have been superseded by the use of an Acucise device (applied medical ureteral cutting balloon catheter). Post op stenting is required for 6 weeks, with a 100% success rate being reported in a small series of patients. In a much larger series of adult patients, Kim et al reported an overall success rate of 78%. CT or MRI to be done preoperatively to assess crossing vessel, so catastrophic haemorrhage is avoided by injuring the vessel by Acucise endopyelotomy. Fluoroscopic documentation of successful incision and or dilation of UPJ, a double pigtail ureteral stent is placed under direct vision in the renal collecting system and fluoroscopically positioned into the bladder. After successful endopyelotomy a double pig tail stent is maintained for 6 weeks.

Laparoscopic pyeloplasty

Schuessler first described laparoscopic management of the obstructed UPJ in 1993 [56]. Following this it soon became established as both a safe and efficacious technique in expert laparoscopic hands. The main advantage of a laparoscopic approach to UPJO over the minimally invasive alternatives described above is the ability to replicate each step of the open surgical procedure. Thus, laparoscopy provides a

combination of the excellent success rates of open surgery with the advantages of decreased pain, short hospital stay, and an early return to full activity for the patient.

In the transperitoneal approach, the ureteropelvic junction can be accessed in either a retrocolic or a transmesenteric fashion. Kavoussi and associates state that the solitary indication for transmesenteric access to the UPJ in their hands is recognition of the renal pelvis and/or ureter through a relatively transparent descending colonic mesentery [57].

Laparoscopic techniques for the correction of UPJO are well defined and adhere to the surgical principles of conventional open pyeloplasty. As increasingly mature experiences are published from institutions worldwide, laparoscopic pyeloplasty is gaining acceptance and has become the standard treatment at many US and European centers. Although laparoscopic pyeloplasty yields excellent results, it is clearly a complex procedure with a long learning curve, and therefore reserved to centers with experience in laparoscopy [55].

Outcome

Adherence to sound surgical principles, minimal handling of the ureter at the time of repair and judicious use of internal stenting or nephrostomy tube drainage ensure a successful outcome. Success is defined as improvement in function on renal scan along with a decrease in washout time. If a nephrostomy tube is placed, nephrostogram is performed at 10 – 14 days after surgery, allows visualization of the anastomosis. If a

double pigtail ureteral stent is left indwelling, it is removed 6 – 8 weeks after the initial procedure. A renal ultrasound is obtained 6 weeks after pyeloplasty or after stent removal to ensure that the hydronephrosis is improving. A renal scan is obtained 6 month to 1 year after the pyeloplasty to provide relative assessment of the overall renal function. Long tem imaging at 3 years may be obtained to look for that rare situation of delayed cicatrisation and restenosis of the UPJ.

Complication

Early complications of pyeloplasty are uncommon and usually involve prolonged urinary leakage from penrose drain. Depending on the amount of drainage, observation is generally the best approach. If it persists beyond 10 – 14 days, placement of a retrograde ureteral stent can often rectify the situation. Spontaneously delayed opening of the anastomosis has occurred as late several months after the repair. Lack of drainage for a prolonged period would necessitate further intervention including an endopyelotomy, redo pyeloplasty or even uretero calicostomy.

RESULTS

32 patients were diagnosed as a case of ureteropelvic obstruction, out of which 5 patients with bilateral disease were excluded from the study.

Age at surgery

Of the 27 patients included in the study most of the patients presented with the age group of 3 to 6 years which was 12 in number and the smaller patients with age less than one year was 7 which includes 6 patients who were detected antenatally. There was less number of patients above the age of 10 years (figure 7) Table 2

Fig 7: Distribution according to age at surgery (in months)

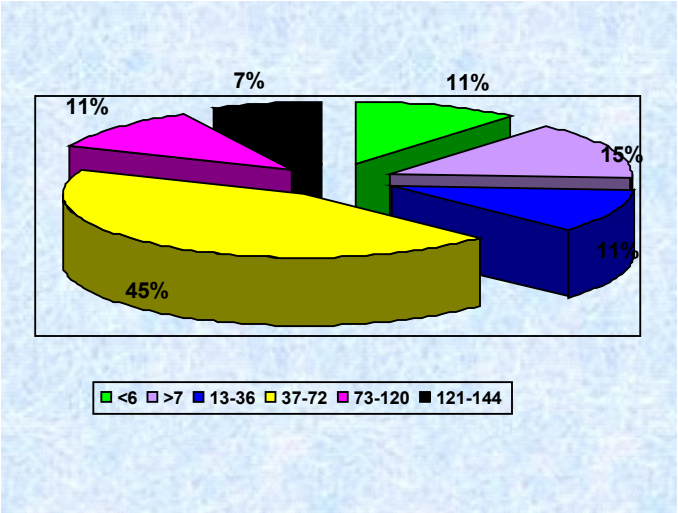
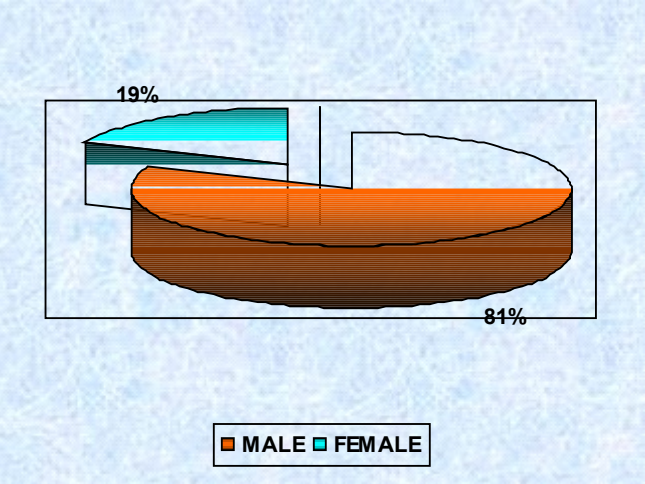


Table 2: Age distribution in months

Age in months	Number of patients
< 6 months	3
7 months to 12 months	4
13 – 36 months	3
37 – 72 months	12
73 – 120 months	3
121 – 144 months	2



Distribution according to sex

Of the 27 patients we had 22 male patients and 5 female patients, indicating a male female ratio of 4.4: 1 Fig 8, table 3

Fig 8: Distribution according to sex

Table 3: Distribution according to sex

Male	22
Female	5

Distribution according to the side of the lesion

Of the 27 patients the majority of patients had left sided lesion with a total of 17 patients and on right side it was 10 in number (fig 9, Table 4)

Fig 9: Distribution according to the side of the lesion

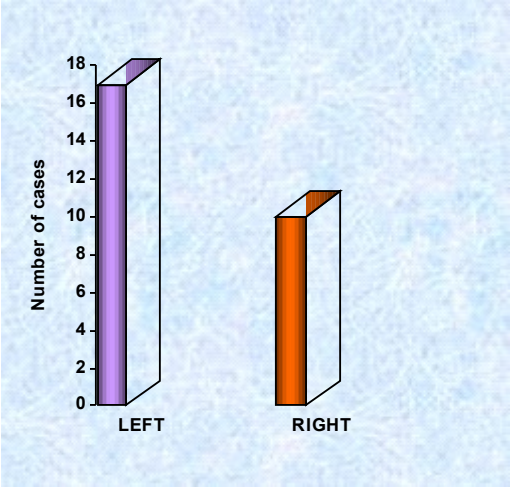


Table 4: Distribution according to side of lesion

Left	**17**
Right	**10**

Distribution according to symptoms

Of the 27 patients 6 patients were diagnosed antenatally by ultrasound and confirmed by post natal ultrasound, the most predominant symptom was abdominal mass which was in 16 patients and the rest of the symptoms were pain abdomen, urinary tract infection Fig 10, table 5

Fig 10: Distribution according to presentation

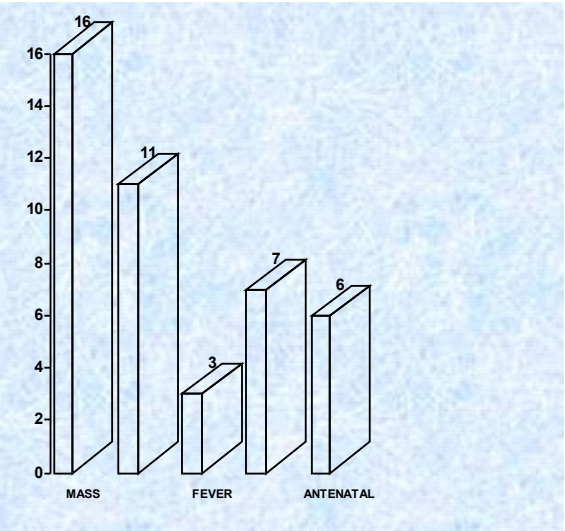


Table 5: Distribution according to symptoms

Mass abdomen	16
Pain	11
Fever	3
UTI	7
Antenatal	6

Comparison of pre and post operative ultrasound grading

There were 19 patients who were diagnosed as a case of grade III hydronephrosis according to SFU grade, 4 patients with grade IV and on follow up of these patients with ultrasound at 3 months or later it was found that all the 27 patients had improvement in

comparison to the previous scan indicating 100% improvement in grading Fig 11, table 6.

Fig 11: Comparison of pre op and post op USG grading of Hydronephrosis

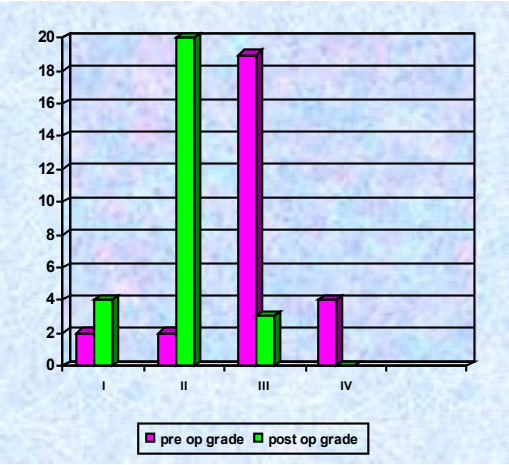


Table 6: pre and post operative SFU grading of hydronephrosis

	Grade I	Grade II	Grade III	Grade IV
Pre op USG	2	2	19	4
Post op USG	4	20	3	0

Comparison of pre operative and post operative GFR

The average GFR pre operatively was 36.32 (range 6.3 – 70.5) the majority of the patients had a GFR between 31 and 50. The poorest GFR of 10 to 20 was seen in 5 patients. On comparing the GFR status pre op and post op there was definitive improvement in overall GFR 37.4 (range 7.4 – 62). The average percentage raise of GFR was 0.4% Fig 12, Table 7

Fig 12: Comparison of pre operative and post operative GFR (average)

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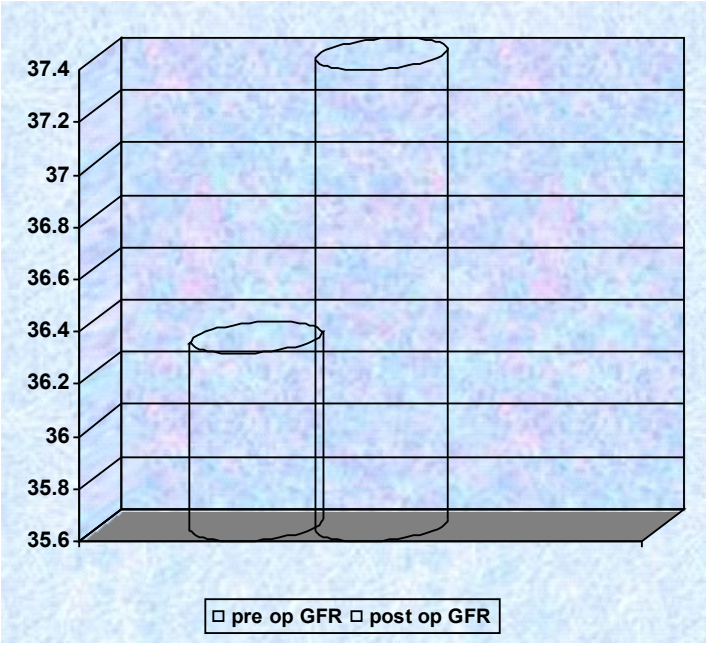
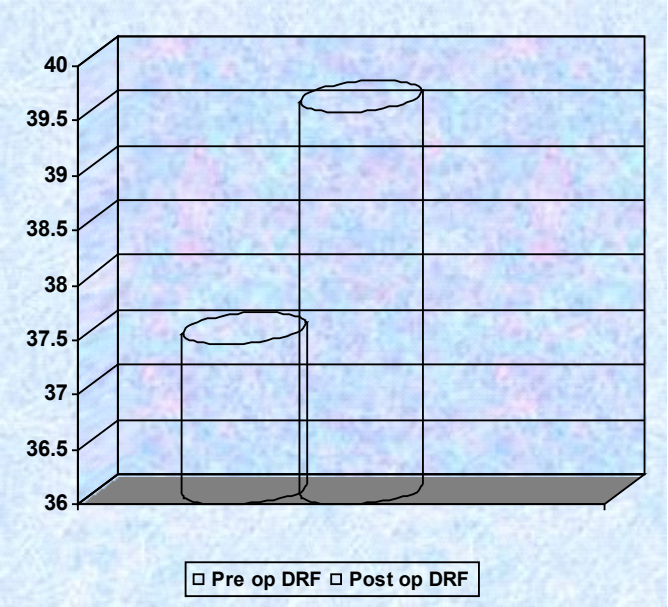


Table 7: comparison of preoperative and post operative GFR

GFR	Pre op patients	Post op patients
10 – 20	5	3
21 – 30	4	4
31 – 40	7	9
41 – 50	7	7
51 – 60	2	3
> 60	2	1
Average GFR	36.32	37.4



Pre operative and postoperative Comparison of differential renal function

The preoperative average differential function 37.47 (range 14 – 54) and post operative DRF was 39.59 (range 13 – 51). There was overall improvement in function by 0.5 %. There were 3 patients with supra normal function of the affected kidney out of which one patient had become normalized function postoperatively. On comparison with post op DRF 3 patients had poor function compared to the previous renogram of which 2 had obstructive pattern.

Fig 13: Pre operative and postoperative Comparison of differential renal function

Table 8: comparison of pre op and post operative Differential renal function

% function	Pre op patients	Post op patients
10 – 20	3	2
21- 30	3	3
37 – 40	10	6
41 – 50	8	14
> 50	3	2
Average function	37.47	39.59

Improvement status of the kidney by renogram - follow up

Of the 27 patients the followup renogram showed an improved differential function in 18 patients, static in 6 patients, 3 patients had worsened renal function. One patient had Nephrectomy for pyonephrosis on followup and 2 patients underwent redopyeloplasty for recurrent symptoms and obstructive pattern on followup renogram. Fig 5, Table 9

Fig. 14: Post up follow up status of Hydronephrosis

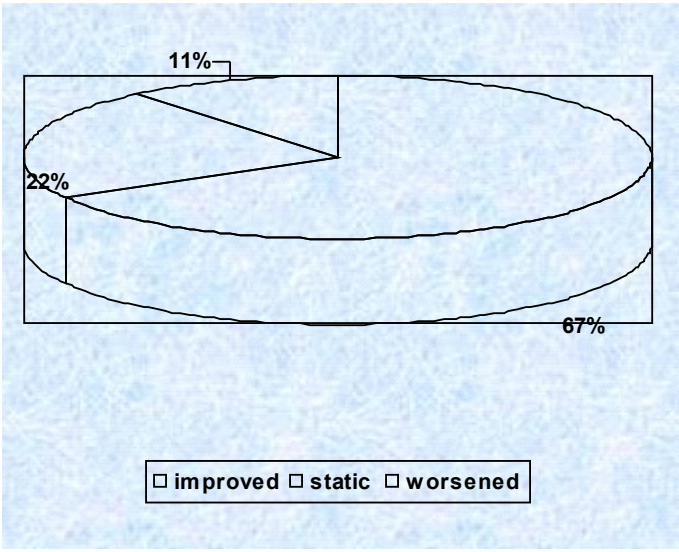


Table 9: Post operative status of the kidney by renogram

Improved	18	67%
Static	6	22%
Worsened	3	11%

Complications during followup

Of the 27 patients who underwent surgery 3 patients had Urinary tract infection those were managed with conservative treatment with specific antibiotics according to urine culture and they improved. Two patients underwent Redopyeloplasty because of recurrent symptoms, both the patients had recurrent mass abdomen and obstructive curve pattern on radioisotope scan, both the patients had fibrous adhesions with narrowing of the pelviureteric junction obstruction. 2 patients had retained DJ stent (which could not be identified by cystoscopy because of stent migration) for which open exploration was needed to remove the stents. One patient had nephrectomy because of pyonephrosis fig 15, table 10.

Fig 15: Complications during follow up

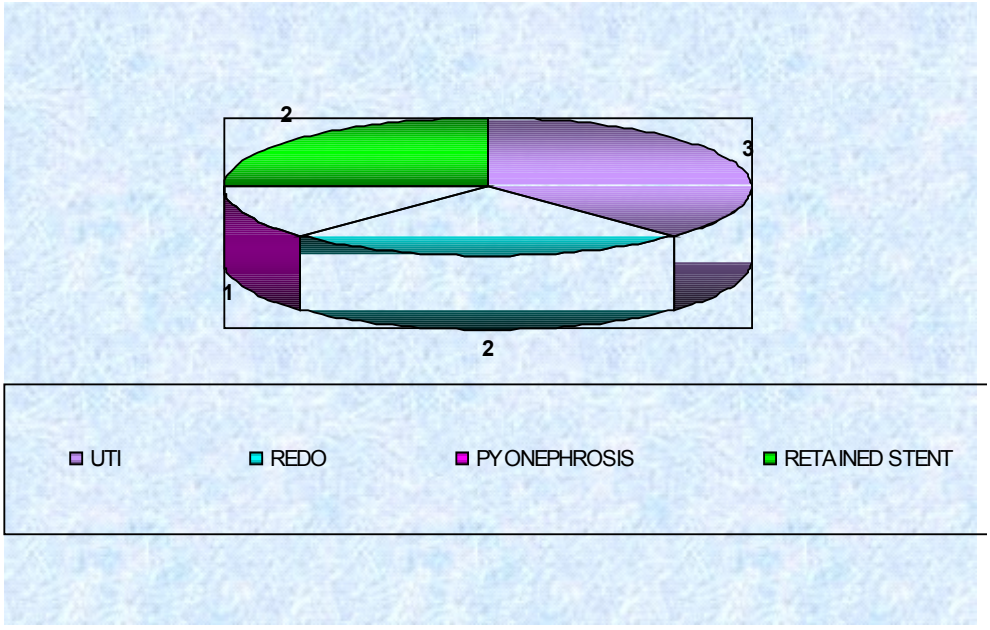


Table 10: Complications during follow up

Complication	number
Urinary tract infection	3
Retained DJ stent	2
Redo pyeloplasty	2
Pyonephrosis	1

DISCUSSION

Among the 27 patient there were 6 patients detected to have hydronephrosis antenatally which accounts for 22.2%, whereas in literature there were nearly 50% of patients detected antenatally [49]. Of the six patients 3 patients underwent early pyeloplasty before 5 months and the rest before their first birthday.

According to our series left sided lesion was 62.96% than the right side which correlates with the literature which gives 66% comparing to the other side [58].

Males are commonly affected than females with a ratio of 4.4: 1 according to our studies and the literature showed a ratio of 2:1

According to symptoms most of the patients presented with mass abdomen which accounts to around 59%, pain (41%) and other symptoms that includes fever and urinary tract infection.

Several reports have advocated early relief of UPJO to allow function to recover or to prevent further loss of kidney function [5,47] . Some studies have suggested that affected kidneys with good DRF at the time of diagnosis are less likely to manifest deterioration of renal function after surgery [3]. In contrast, other series concluded that renal function did not improve after pyeloplasty, regardless of the initial level of renal function [2]. Salem et al. also observed that only kidneys with impaired preoperative function were associated with greater degrees of improvement after surgery [9]. In the study by Zaccara et al., an increase or decrease in renal function was found to be

randomly distributed among patients operated upon at different ages, and the unpredictability of postoperative renal function was also emphasized [4, 8].

Diuretic renography has been widely used to differentiate true obstructed hydronephrosis. However, some authors have questioned the interpretation of the obstructive patterns of diuretic renography and drainage half-times for the diagnosis of hydronephrosis [49, 50]. The definition of obstruction based on a 20-min washout after the diuretic challenge is useful in symptomatic older children and adults, but assuming that the same criteria can be used in an asymptomatic group of young children has generated debate [4, 49, 50]. One issue is the variable drainage halftime on follow-up diuretic renography, and second is the concern over interpretation of results of diuretic renography showing impaired drainage.

Many institutions have reported inadequate responses to the diuretic challenge without incorporating the important factors of an empty bladder and gravity drainage in acquiring and analyzing the data [4, 51, 52]. It was assumed that progressive renal deterioration had begun only when there was a decrease in renal function and/or progressive dilatation of the renal pelvis.

We analyzed 27 patients, post operatively with followup ultrasound to know the grade of hydronephrosis (SFU) and Diuretic renogram to know the post operative GFR and Differential renal function. According to the post operative ultrasound which was done 3 months later showed that there was 100% improvement, i.e., the SFU grading has come down from the preoperative size.

According to diuretic renogram DRF was stable in 18 patients, static in 6 and decreased in 3. The average DRF preoperatively in our patients were 37.47 (range 14 – 54) and post operatively DRF has increased to 39.59 (range 13 – 51). There was overall improvement in renal function. There was a definitive improvement in renal function in 88.9% of our patients. 2 of our patient who had DRF of 41 and 39% of function preoperatively had a post operative function 32 and 29% respectively with symptoms and an obstructive curve pattern. Both these children underwent surgery for recurrent obstruction during the follow-up period had redo pyeloplasty at 13 months and 18 months respectively, on exploring the kidney both the children had narrow ureteropelvic junction with fibrosis, and the standard Anderson Haynes dismembered pyeloplasty was done with a Double J stent. The following table shows the comparison of different study group to our series (table 11)

Table 11. Comparison of various studies in success after pyeloplasty

Author and year	Patients / Kidney	Success %
Our study 2009	**27**	**88.9**
O ' Reilly 1989	30	83
Mac Neily et al 1993	75	85
Salem et al 1995	100	98
Mc Akar & Kaplan 1999	79	90
Austin et al 2000	135/137	91
Houben et al 2000	186/203	93
Paulsen et al 1987	35	100

In fact, the patient who presented with a postoperative decrease in DRF had a preoperative renal scan showing supra-normal renal function (SNRF) with renal function up to 54%. The problem of SNRF has previously been encountered and reported in the

literature [53]. At present, the phenomenon is not well understood. Although this patient had, according to our definition, deteriorating renal function after surgery in comparison to preoperative values, the DRF had nearly returned to normal compared to the contra lateral kidney. Therefore, this patient should not have been assigned to the group with decreased DRF, upon consideration of these data. In our series there were 3 patients with supra normal renal function with 53, 54 and 52% and post operatively their renal function was 48% in the first 2 patients and 44% in the last patient.

One patient who had recurrent urinary tract infection post operatively diagnosed to have pyonephrosis on followup underwent nephrectomy of the involved kidney. In other words, of the 27 patients from our study 24 patients had improved or stable renal function, 2 had poor function with obstruction and one patient developed pyonephrosis post operatively.

We observed that all 24 children in our study had stable hydronephrosis for at least a 6 months (range 6 months to 3 years) follow-up period with respect to pelvic size on ultrasonography and DRF on renal cortical scan. Stable hydronephrosis was considered to provide reassurance that the ureteropelvic junction remained patent unless symptoms persisted. Thus, those kidneys with prolonged drainage were considered not to have obstructed hydronephrosis.

One study, which was similar to our investigation, reported that prolonged drainage half-time and/or high-grade hydronephrosis is an indicator neither of renal obstruction nor for surgery [54]. When diuretic renography is performed, the importance of

allowing the bladder to empty as well as having the patient in an erect posture has previously been described [12, 50]. Improvement in renal drainage half-time after voiding and changing gravity while the patient is standing has been reported [(4, 50)].

In conclusion, Anderson Haynes pyeloplasty which is a gold standard surgical treatment for ureteropelvic junction obstruction needs to be followed up with Radionuclide scan to know the post operative function of the kidney, the only way to assess the functional status of the kidney. The need for redopyeloplasty is based on symptoms and the deteriorating renal function.

CONCLUSION

In conclusion, the follow up protocol for pyeloplasty presented here is simple and reliable with the least risk of functional deterioration during the follow-up. The need for preoperative and postoperative sonogram and DTPA is necessary to evaluate the functional status of the kidney. DTPA is especially useful and more informative in regard to the differential function and GFR. However preoperative supranormal function of kidney may show normal or less function in the post pyeloplasty scan, which has to be considered. Obstructed pattern with diminishing function on follow up diuretic renogram may be an indication of redo surgery. Successful pyeloplasty relies on improved symptoms, renal drainage, GFR and differential function, which is detected by diuretic renogram.

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